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⑪ Improvements to valves for gas cylinders.

⑫ The disclosure relates to an arrangement in a valve for high-pressure gas cylinders, primarily for oxygen gas cylinders, in order, during the opening phase, to prevent gas-rush through the valve, the valve comprising an inlet connection (1) intended to be screwed into the gas cylinder and including an inlet passage (3) for the gas. A tubular sleeve member (6) is disposed in the gas passage and is axially movable along a predetermined distance. When the valve is closed, the one end of the sleeve member (6) abuts against the movable sealing member (5) of the valve, and its other end abuts against spring means (10) disposed in the gas passage. The sleeve member (6) is of such diameter that a gap (18) is obtained between the sleeve and the gas passage wall, the sleeve (6), in the initial phase of the opening movement of the valve, abutting against the movable sealing member (5) along the above-mentioned distance, such that a slight volume of gas flows through the gap, and, on further opening movement, the movable sealing member departs from the sleeve (6) and full gas flow is obtained through the valve.

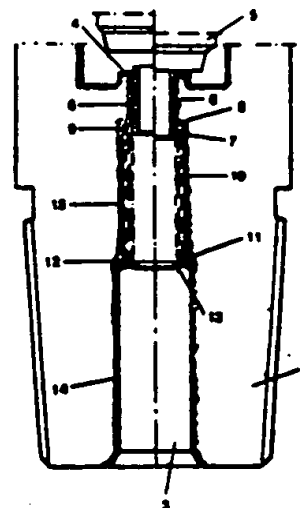


Fig. 2

Description

IMPROVEMENTS TO VALVES FOR GAS CYLINDERS

TECHNICAL FIELD

The present invention relates to an improved arrangement in valves for high-pressure gas cylinders, primarily oxygen gas cylinders, in order, during the opening phase of the valve, to prevent gas-rush - or as popularly entitled "gas hammer" - through the valve, the valve in the arrangement according to the present invention including an inlet connection intended to be screwed into the gas cylinder and containing an inlet passage for the gas.

BACKGROUND ART

It is previously known in this Art that if a valve connection to a gas cylinder containing oxygen gas or oxygen-enriched gas at high pressure is quickly opened - or "snatched open" - ignition may occur in the valve or in the equipment connected to the valve, for example a regulator. In such an event, not only may the component in question be destroyed, but such an ignition may also entail damage to other parts in the gas distribution system. In order that such ignition can take place, it is necessary that three elements be present, namely oxidation agent, fuel and ignition energy. Here, the oxygen is the oxidation agent and the valve material is the fuel. The ignition energy consists of the compression heat generated when the gas is compressed from low to high pressure. In the present case, when high-pressure oxygen is released into the valve chamber and rapidly compresses the residual oxygen in the chamber, a violent increase of the temperature of the gas will be obtained. This temperature increase may exceed the threshold ignition temperature of the material. If, for example, in a valve, oxygen is rapidly compressed from 1 bar and 20°C to 200 bar, the ultimate temperature of the gas will be of the order of magnitude of approx. 1 200°C. In a valve which is made of brass and which may also contain components of other materials, ignition may take place in the event of such a rapid compression, with consequential temperature increase.

OBJECT OF THE PRESENT INVENTION

The object of the present invention is to realise an arrangement in the valve which prevents gas-rush through the valve and, as a result, the rapid compression of the gas. The present invention is, here, essentially characterised in that a tubular sleeve member is disposed in the gas passage of the valve connected to the gas cylinder, the sleeve member being axially movable a predetermined distance, and one end of the sleeve member abutting, when the valve is closed, against the movable sealing member of the valve, and the other end of the sleeve member abutting against spring means disposed in the gas passage, the diameter of the sleeve being such that a gap is created between the sleeve and the wall of the gas passage, the sleeve, during the initial phase of the opening movement of the valve spindle, abutting against the

movable sealing member along the above-mentioned distance such that a minor volume of gas will flow through the gap and, on further opening movement of the valve spindle, the movable sealing member will depart from the sleeve and maximum gas flow will be obtained through the valve. The invention is further characterised in that the gap width and gap length are dimensioned such that, in the above-mentioned initial phase, the rising time of the gas flow to maximum flow is of such duration that the gas compressed in the valve housing during the rising time of the gas flow will attain a temperature which is lower than the threshold ignition temperature of the valve material.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The nature of the present invention and its aspects will be more readily understood from the following brief description of the accompanying Drawings, and discussion relating thereto.

In the accompanying Drawings:

Fig. 1 is a longitudinal section through a conventional gas cylinder valve;

Fig. 2 is a cross-section through the inlet connection and component parts inserted therein; and

Fig. 3 illustrates graphically the gas flow through the valve, on the one hand for a conventional valve, and, on the other hand, for a valve fitted with the arrangement according to the present invention.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the Drawings, Fig. 1 shows a cylinder valve. This comprises an inlet connection 1 intended to be screwed into a gas cylinder, and an outlet connection 2 intended for connection to an outlet conduit. Gas from the cylinder passes through the gas passage 3 and, if the valve is open, past the valve seat 4 and out through the channel in the outlet connection 2. The valve is closed by turning the valve knob, in which event the movable sealing member 5 is, by means of the operating mechanism of the valve (in the illustrated embodiment a spindle and ball), urged against the seat 4 and thereby closes the gas passage 3. When the valve is opened, the movable sealing member 5 is, thus, lifted from the valve seat 4.

Fig. 2 illustrates the outlet connection 1 and the lower portion of the movable sealing member 5 when the valve is opened and when the valve is closed, in each half of the Drawing, respectively. Bores 14 and 15 are provided in the gas passage 3 in the outlet connection. A sleeve-shaped member 6 is disposed in the gas passage most proximal the valve seat 4. This member is provided with a flange 7 at its end facing away from the valve seat. The flange is provided with one or more apertures 9. A spring 10 is disposed in the bore 15 in the gas passage, the flange 7 abutting against the upper end of the spring.

The opposite end of the spring 10 abuts against a backing washer 11 which is disposed in the bore 14. In the illustrated embodiment, the washer 11 is held in place by a locking washer 13. However, it is also conceivable without departing from the spirit and scope of the present invention to thread the backing washer in place in the bore.

The sleeve 6 is disposed to be axially movable in the gas passage. Moreover, the sleeve 6 is of such diameter that a gap 16 is formed between the sleeve and the gas passage wall. However, movement towards the valve seat is restricted by the end surface 8 of the bore 15. When the valve is closed (the right-hand half of Fig. 2), the end surface of the sleeve 6 will, because of the action of the spring 10, abut against the movable sealing member 5, in which case no gas can pass from the gas passage into the valve housing. When the valve is opened by turning the valve knob, the movable sealing member 5 will move away from the seat 4. However, the end surface of the sleeve 6 is held urged against the movable sealing member by the action of the spring 10. The sleeve 6 will abut against the sealing member a distance which corresponds to the travel of the flange 7 to the end surface stop 8 in the gas passage. Once the movement of the sleeve has been arrested, the sealing member 5 is released and the valve is fully open (the left-hand half of Fig. 2).

During the time the sleeve 6 abuts against the sealing member 5, gas will now flow from the gas passage through the apertures 9 in the flange 7 into the gap 16 between the sleeve wall and the wall of the gas passage. Because the valve seat 4 is somewhat chamfered, viewed from the centre, a gap will be created between the seat and sealing member through which gap the gas flows out into the valve housing. During the first phase of the opening movement of the valve, there will hereby be obtained a gas flow solely through the above-described gaps. Not until the sealing member 5 has departed from the end surface of the sleeve 6 will maximum flow be obtained through the valve.

The gap between the sleeve 6 and the wall of the gas passage has been given a specific width and length, since the gas flow rate through the gap is determined by these magnitudes. The gap width and gap length are, here, dimensioned such that, during the initial phase of the opening movement of the valve, a rising time for the gas flow from zero to maximum flow is obtained which is of such duration that no "quick" compression of the gas enclosed in the valve housing will be occasioned. The ultimate temperature which the gas attains as a result of this arrangement is considerably lower than the lowest threshold ignition temperature of the valve material. Fig. 3 illustrates the rising time for the gas flow, first for a conventional valve (the upper diagram (a)), and secondly for a valve provided with the novel arrangement according to the present invention (the lower diagram (b)). As will be apparent from these diagrams, the rising time for a conventional valve is approx. 50 msec. and for a valve fitted with the novel arrangement, approx. 300 msec. Hence, by the present invention it has become possible to increase the rising time by a factor of approx. 6. In order to

obtain a rising time which does not give rapid, and thereby dangerous, compression, the gap width should lie in the range of from 50 to 150 μ , and the gap length in the range of from 5 to 15 mm. In the curve illustrated in Fig. 3, a gap width of 80 μ and a gap length of 10 mm were employed.

Thus, by means of the novel arrangement disclosed in the foregoing, it has become possible to avoid the rapid compression, and consequential temperature increase of the gas in the valve housing, whereby the risk of ignition has been obviated. By means of the novel arrangement as herein disclosed, there will always be obtained, during the initial phase of the opening movement of the valve, a constant rising time for the gas flow irrespective of the speed with which the valve knob is turned. As a further result of the novel arrangement as herein disclosed, this constant rising time will also be obtained irrespective of the operating mechanism disposed in the valve between the knob and the movable sealing member, thus irrespective of whether the valve comprises spindle and ball, diaphragm or bellows-type arrangement.

The present invention should not be considered as restricted to that described above and shown on the Drawings, many modifications being conceivable without departing from the spirit and scope of the appended Claims.

Claims

1. In a valve for high-pressure gas cylinders, primarily for oxygen gas cylinders, an arrangement to prevent, during the opening phase, gas-rush through the valve, the valve comprising an inlet connection (1) intended to be screwed into the gas cylinder and containing an inlet passage (3) for the gas, characterised by a tubular sleeve member (6) disposed in the gas passage and axially movable a predetermined distance, the one end of said sleeve abutting, when the valve is closed, against the movable sealing member (5) of the valve, and the other end of said sleeve abutting against spring means (10) disposed in the gas passage, said sleeve being of such a diameter that a gap (16) is obtained between the sleeve and gas passage wall, the sleeve (6), in the initial phase of the opening movement of the valve, abutting against the movable sealing member (5) along said distance such that a slight volume of gas flows through the gap and, on further opening movement, the movable sealing member (5) departs from the sleeve (6) and maximum gas flow is obtained through the valve.

2. The arrangement as claimed in claim 1, characterised in that the end of the sleeve member (6) facing said spring means (10) is provided with a flange member (7) which, when the valve is open, is disposed to abut against a first recess in the gap passage, and which is provided with at least one aperture (9) for continuous gas flow to the gap.

3. The arrangement as claimed in Claim 1, characterised in that gap width and gap length are dimensioned such that, in said initial phase, the rising time of the gas flow to maximum flow is of such duration that the gas compressed in the valve housing during the rising time will attain a temperature which is lower than the lowest threshold ignition temperature of the valve material.

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5. The arrangement as claimed in claim 3, characterised in that the gap width lies in the range of from 50 to 150 μ and the gap length in the range of from 5 to 15 mm.

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4. The arrangement as claimed in claim 4, characterised in that the gap width is preferably 80 μ and the gap length preferably 10 mm.

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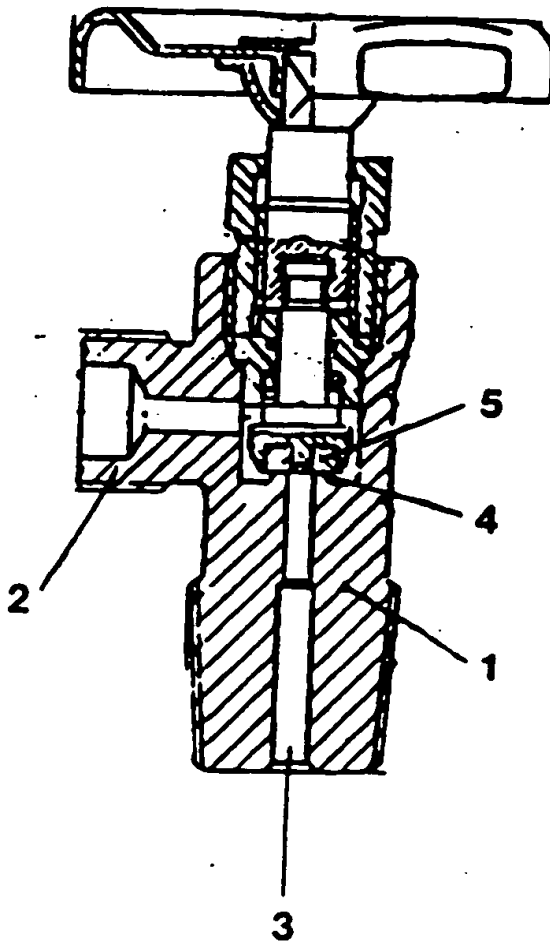


Fig. 1

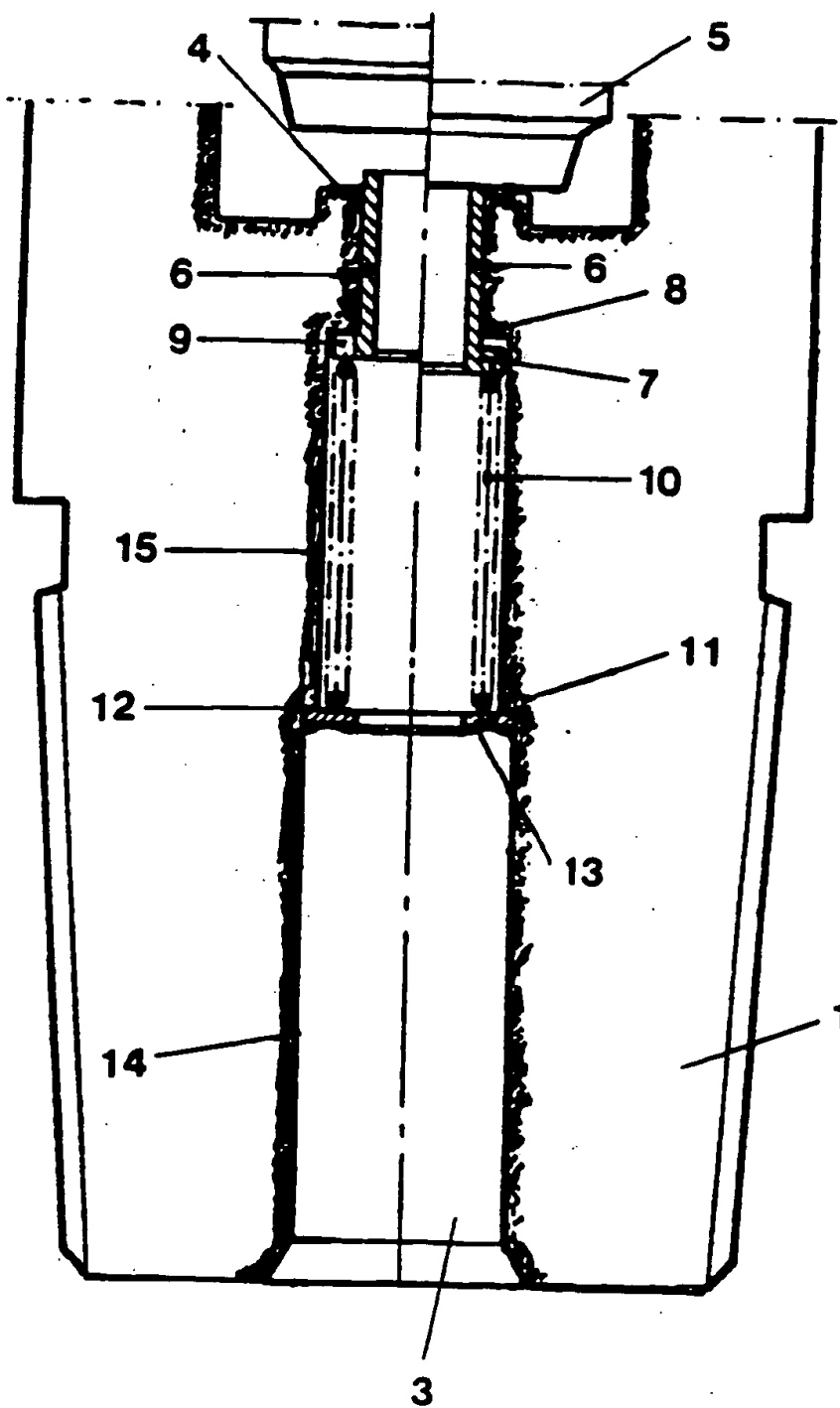
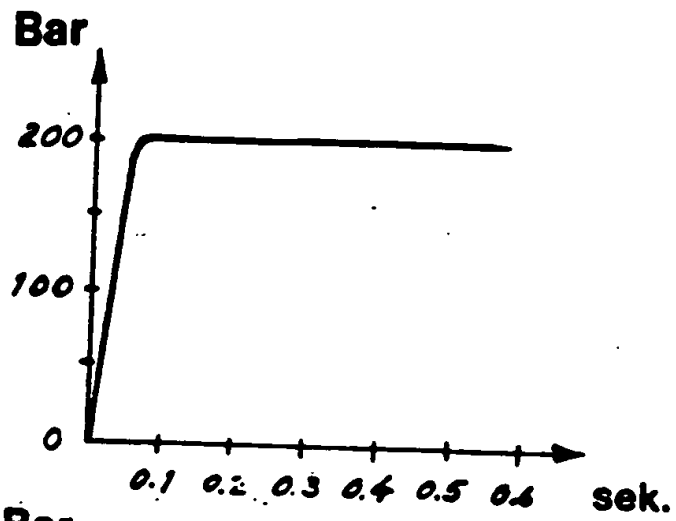


Fig. 2

a.



b.

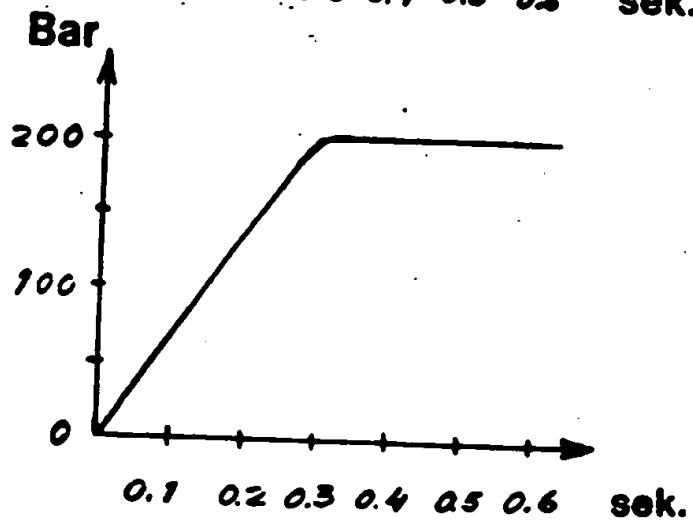


Fig. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 86850338.4
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	DE - A1 - 2 429 071 (UNION CARBIDE) * Totality *	1-3	F 16 K 1/30
A	DE - A - 1 961 439 (VEB KOMBINAT MEDIZIN- UND LABORTECHNIK) * Claims; fig. *	1	
A	DD - A - 77 141 (SCHWANICKE) * Claims; fig. *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			F 16 K 17/00 F 16 K 47/00 F 16 K 1/00 F 17 C 13/00
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 04-12-1986	Examiner MARCHART
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	